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A Study on Pulmonary Function Tests in Diabetes Mellitus and Its Correlation with Duration of Diabetes Mellitus.

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I. Introduction

- Diabetes is one of the important non communicable disease of the modern era, which leads to multi system involvementcardiac, nervous, renal, ophthalmic, genito-urinal, gastrointestinal, dermatological etc.
- Although diabetes is a multi systemic disorder its pulmonaryinvolvement is not extensively studied.
  - Pathological studies in diabetic patients haverepresented changes in alveolar epithelium and capillaries.
  - The consequenceis development of obstructive or restrictive disorders.
  - Despiteadvancementsinunderstandingthepathogenesisofdiabetesandthecomplications,thepathology of lung involvement is not well established.
  - The PFT might show a restrictive pattern

II. Proposed Mechanisms

- **Advanced glycation of end products (AGE's)**

-first due to the pro inflammatory effect of AGE's .
-Second one is functional alteration of lung connection tissue by AGE's .

- **Micro vascular involvement**-

-lead to changes in lung parenchyma. Due to endothelial dysfunction vasodilation does not occur.

- Insulin resistance may also play role in lung dysfunction.
- Neuropathy of thoracic nerves leading to respiratory muscle abnormality may have a role

 With these proposed mechanisms it is clear that pulmonary involvement is similar to other microvascular complications of diabetes and may co exist with other micro and macro vascular complications.

 If diabetes is detected early and adequate steps are taken, it may be possible to significantly delay the occurrence of complications and there after their progression.

III. Aim and Objectives

The present study is conducted to find the relation between duration of diabetes and its impairment of pulmonary function tests (PFT) in Type 2 DM patients.

METHOD OF STUDY

STUDY DESIGN: A hospital based Case Control study. Study subjects:

- Fifty diabetic patients previously diagnosed, Every 5th patient belonging to either sex attending / admitting to Medical OPD/wards of Sri venkateswara Ramnarain Ruia Government General Hospital, will be studied.
- Patients will be classified into three groups A, B, C depending on the duration of diabetes.
- Group A consists of diabetes with duration of up to 3 years.
- Group B consists of diabetes with duration of 3to 5 years.
- Group C consists of diabetes with duration of 5 to 7 years.

STUDY SETTING : Medical wards, OPD in SRI VENKATESWARA RAMNARAYAN RUIA GOVERNMENT GENERAL HOSPITAL,TIRUPATI.

STUDY PERIOD : JANUARY 2019 to MARCH 2019

STUDY METHODS:

- Patients were made to undergo pulmonary function tests using Medspiror, for 3 times at every 15 minutes interval and best of 3readings was taken. The Forced Vital Capacity (FVC), Forced Expiratory Volume at the end of one second (FEV1), Peak Expiratory Flow Rate (PEFR),FEV1/ FVC ratio were recorded.
- Diabetes mellitus was ruled out in non diabetic group by fasting and post prandial blood glucose was analysed by GOD-PAP(glucose oxidase-phenol 4- aminophenazone peroxidase)method.
- Other relevant investigations are done like ECG , Echocardiogram, Fasting and 2 hr blood sugar, Chest XRAY

INCLUSION CRITERIA :

• Previously diagnosed Type 2 Diabetic patients for less than 7 years, between age 40-60 years , with regular follow up.
• Fifty age and sex matched non diabetic were included as the other group.
• Diabetes was ruled out in non diabetic group with fasting and 2-hr post prandial blood glucose measurement.

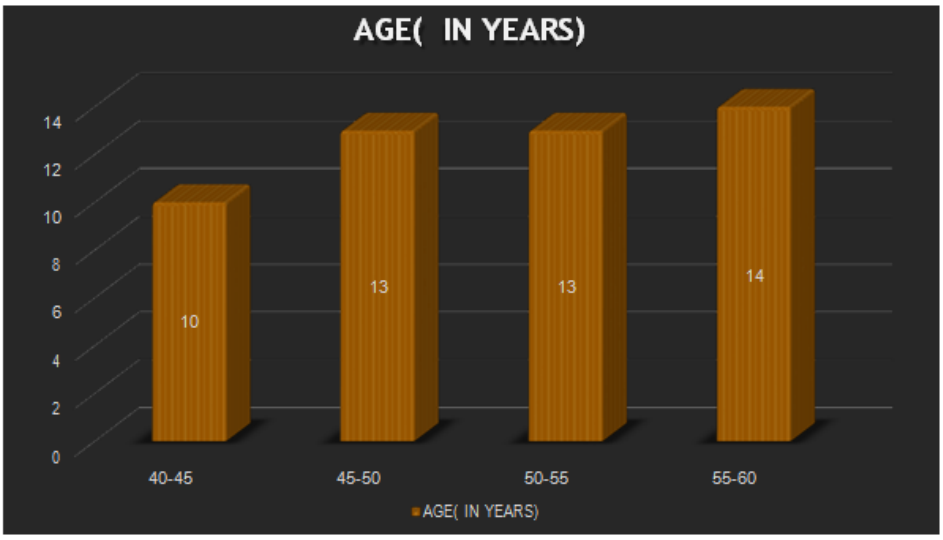
EXCLUSION CRITERIA :

• Smokers
• Patients with previous/present cardio respiratory diseases
• H/o occupational exposure
• Persons with physical disabilities
• Obese (BMI>30) • Neuromuscular diseases

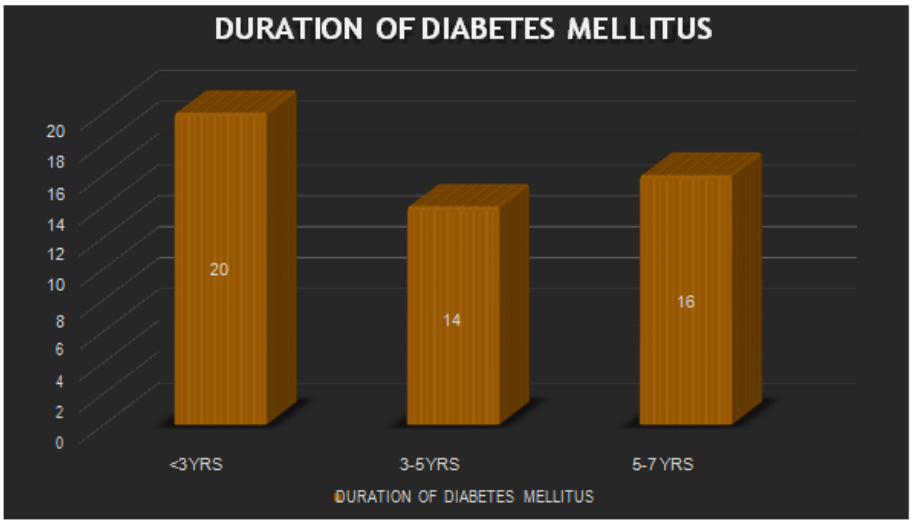
IV. Results And Statistical Analysis

- Statistical analysis was done by using percentages, mean values, standard deviation, chi-square test, t-test and proportion test.
- A p-value <0.05 level was considered statistically significant and a p-value >0.05 was considered as not statistically significant.

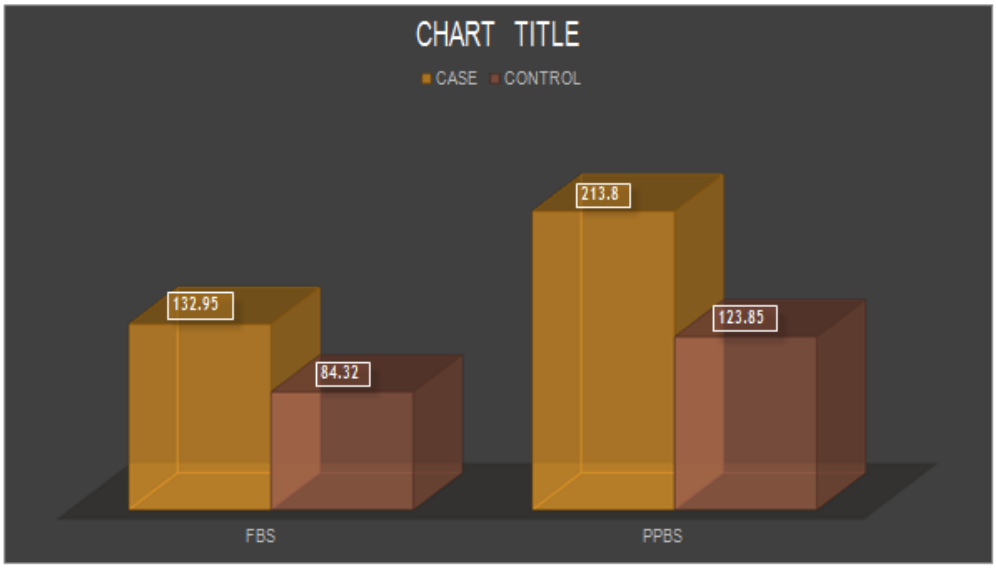
AGE DISTRIBUTION



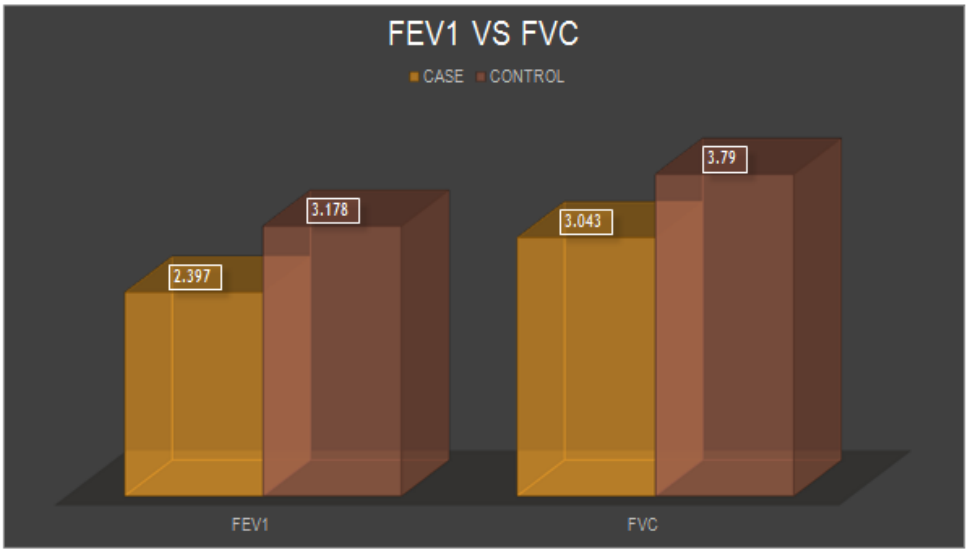
No. of Cases



FBS AND PPBS COMPARISION



FEV1 VS FVC



COMPARISION	CASE		CONTROL		P' VALUE
	MEAN	SD	MEAN	SD	
FBS	132.95	14.714	84.32	8.102	<0.001
PPBS	213.8	34.737	123.85	15.086	<0.001
FEV1	2.397	0.476	3.178	0.437	<0.001
FVC	3.043	0.568	3.79	0.603	<0.001
FEV1/FVC(%)	78.77	3.938	83.85	5.45	
PEFR	486.75	73.568	536	72.744	<0.001

V. Discussion

- Diabetes is a multisystem disease. Involvement of cardiac,renal,ocular systems are more extensively studied when compared to lung involvement. The cause of lung function has not been studied. There are no detailed proposed mechanisms for it . Possible mechanisms are microvascular changes in lung tissue will lead to impairement in pulmonary functions.
- Few studies have shown that T2DM with microangiopathies show reduced diffusion capacity for carbon monoxide (DLCO).
- The study further suggested that hyperglycaemia and dyslipidaemia might have a contributory role in its pathogenesis.
- In this study we found that diabetics had decreased lung volumes compared to normoglycemic subjects. FVC, FEV1,FVC/FEV1 & PEFR were statististically significantly lower in diabetic patients than in normal controls ($p<0.05$)
- In the present study, hundred patients were taken, of which 50 patients are diabetic and 50 patients non diabetic.
- Pulmonary function tests was compared between these two groups, along with comparison of other parameters.
- On analysing results, patients had significant impairment in FEV1 (2.397 in patients when compared with 3.178 with controls) for which the p value was <0.001 which is statistically significant.
- This concludes have a significant reduction in the FEV1 when compared with the controls.
- Also FVC was 3.178 among cases when compared with controls 3.79 which also showed a statistically significant reduction.
- Our results showed a similar results with schanek et al,ljubic et al. Similar to our study Gregory L. Kinney et al have observed a moderate reduction in FVC,FEV1 and diffusing capacity for carbon monoxide of the lung in patients with type 1 and type 2 diabetes.
- YehHC et al have suggested that pulmonary function test in middle aged non diabetic adult showed a restrictive pattern of lung pathology which is predictive of subsequent type 2 diabetes.
- David et al studied 495 diabetic patients and recorded baseline values. A subset of 125 patients were studied after 7 years, who showed a significant reduction in the FEV1,FVC,PEFR .
- Irfan et al studied 64 diabetic and 64 non diabetic patients and showed that diabetic patients had reductions in FEV1,FVC when compared with non diabetic controls. This result concurred with our result.
- The FEV1/FVC % in our study was lower than normal and was found to have restrictive pattern. This is in concordance Boulbou et al ,Sultan et al, Sreeja et al, Fimognari et al, and Nakagima et al.
- Studies of klein OL stated diabetics have reduced FVC more consistent than reduced FEV1 and our study had given similar results. PEFR was also reduced in our study which was similar to Sreeja et al.
- Among the groups A,B,C the pattern of restrictive PFT is more prominent as the duration advances FEV1(A=2.65 B=2.61 C=2.17) , FVC(A=3.33 B=3.33 =3.17) PEFR (A=509 B=480 C=463).
- So which gives the impression that restriction is more prominent as the disease duration advances.
- Despite the reduction in FEV1&FVC, FEV1/FVC%(A=79.56 B=79.53 C=77.53) ratio declines but which is more than the predicted value.
- Davis et al had reported that FEV1% declines approximately about 1.5 % for each year of diabetes.

- Kanya Kumari et al studied 125 patients and showed that type 2 diabetes patients have a restrictive pattern of PFT. And the restriction is more prominent as the duration of diabetes is prolonged which concurs with our study.
- Anuradha et al, Kapoor et al also had similar results in their results.
- Also patients had higher mean FBS(132.95),PPBS(213.8) than healthy controls FBS(84.32),PPBS(123.85).
- Interestingly patients with higher FBS,PPBS had more decrease in PFT values when compared with lower FBS,PPBS which was also statistically significant.

VI. Conclusions

- Type-2 diabetic patients have reduced Fev1,Fvc,Pefr when compared with non diabetics of same age .
- Type 2 diabetic patients have a restrictive pattern of pulmonary function tests even in the absence of any symptoms. This restrictive pattern is more prominent as the duration of diabetes is increased.
- Thus spirometry can be used as a simple investigation to study the pulmonary morbidity among the diabetics and to plan for an effective aggressive strategy in management of diabetes.
- Periodic monitoring of lung functions is nessacary in diabetics as spirometry is a cost effective, non-invasive tool.

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